

NASA TECHNOLOGY EVALUATION FOR ENVIRONMENTAL RISK MITIGATION REMEDiation TECHNOLOGY COLLABORATION DEVELOPMENT

Project Profile: In Situ Chemical Oxidation (ISCO)

NASA is committed to finding solutions to agency cleanup problems that are better, cheaper, and more effective than the status quo. Unfortunately, some potential solutions involve innovative technologies for which NASA remediation managers may not have a high level of understanding or confidence.

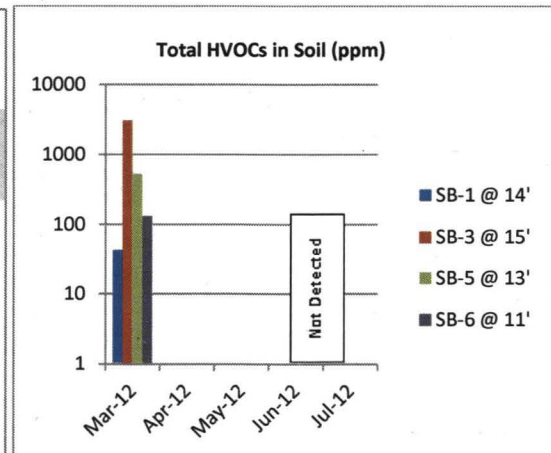
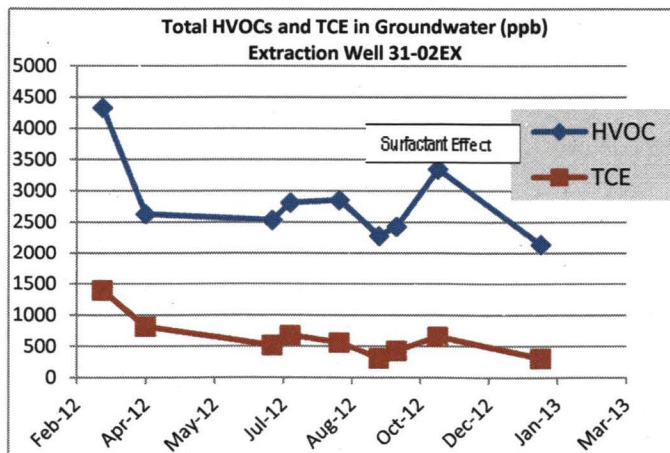
Since 2004, NASA's Stennis Space Center (SSC) in Mississippi has been pumping groundwater contaminated with trichloroethylene (TCE) and other halogenated volatile organic compounds (HVOC) from their cleanup location designated "Area G" through extraction wells to an aboveground treatment system. Over time, however, the effectiveness of this treatment strategy has diminished and an alternative approach is needed.

In 2012, professionals from NASA's Principal Center for Technology Evaluation for Environmental Risk Mitigation (TEERM) introduced SSC managers to an innovative technology for enhancing the performance of SSC's existing pump and treat system. The technology, generally referred to as in situ chemical oxidation (ISCO), involves slowly and continuously injecting a strong but safe chemical oxidant into the groundwater. Treatment is enhanced by a "surfactant-type effect" which causes residual contamination from saturated soil to be released into the dissolved-phase where it can be readily oxidized. Any dissolved-phase contamination that was not oxidized can be collected by the extraction well network and treated aboveground. SSC was not familiar with the technology so to increase their confidence, TEERM identified a contractor who was willing to demonstrate their product and process at a significantly reduced price.

An initial, small-scale demonstration of ISCO began at SSC in March 2012 and completed in August 2012. This successful demonstration was followed by three larger-scale ISCO demonstrations between August and December 2012. The contractor's innovative Continuous Injection System (CIS) incorporated "green" and sustainable technologies and practices. A slow injection rate was maintained autonomously by the CIS, eliminating the need for multiple mobilizations of personnel and powered equipment. The CIS was calibrated to deliver only as much reagent as the formation would accept without "short circuiting", minimizing material waste. Public utility water pressure was used to mix, dilute, and inject the reagent. NASA personnel were trained to operate and maintain the system and remote monitoring and injection control capabilities were developed, further reducing the need for contractor mobilizations to the site. An integrated solar photovoltaic panel was used to power the control valves and web monitoring telemetry. SSC provided hydrogen peroxide for the process using their existing supplier for the aboveground pump and treat systems. The only consumable required from the contractor was their proprietary activator to catalyze SSC's peroxide.



The solar/water pressure-powered, web-enabled CIS



At the conclusion of the nine month study, levels of TCE and associated daughter products had dropped by more than 50 percent in ground water samples and were non-detectable in the treated soils. SSC has deemed the demonstrations successful and are assessing where the technology may be deployed next.